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STRUCTURAL ENGINEERING AND STRUCTURAL MECHANICS

SEMINAR

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Engineering Center Clark Conference Room, 2:00pm

Earthquake Ground Motion Time Series for Nonlinear Dynamic Structural Analysis

Nicolas Luco

As the use of nonlinear dynamic analysis of computer models of structures becomes increasingly common in seismic design and evaluation, the need for appropriate input ground motion time series grows. While ground motions at short distances from large magnitude earthquakes are often of most concern, historical recordings of such ground motions are few and far between. Hence, often structural engineers must either select historical recordings from smaller, more distant earthquakes and scale them up in amplitude (in some cases adjusting their frequency content and phasing as well), or use synthetic time series simulated by a variety of approaches. Questions remain, however, with regards to (i) how to select the most appropriate historical recordings, (ii) what target the recordings should be scaled to, as well as the effects of such scaling, and (iii) whether simulated ground motions yield the same structural analysis results as recorded ones, statistically speaking. Several options for arriving at earthquake ground motion time series for nonlinear dynamic structural analysis, and the pros and cons of each, will be presented in this seminar. This will include discussions of uniform-risk rather than uniform-hazard definitions of design ground motions, alternatives to spectral acceleration as a measure of ground motion intensity, and deaggregation of probabilistic seismic hazard or risk analysis results.

Dr. Luco is a Research Structural Engineer with the U.S. Geological Survey in Golden, CO. For the three years prior to joining the USGS in October of 2004, he worked with the natural and man-made catastrophe loss modeling company AIR Worldwide Corporation. He earned his Ph.D. and B.S. degrees in civil engineering, as well as an M.S. degree in statistics, from Stanford University, and earned his M.S. in civil engineering from U.C. Berkeley. His research interests lie at the intersection of structural engineering, probability and statistics, and seismology. In addition to the topics discussed in the seminar, he is currently working on a probabilistic earthquake loss modeling tool for woodframe homeowners and a risk-based methodology for practical post-earthquake assessment of structural functionality.